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RESULTS OF SCIENTIFIC ACTIVITY OF ACADEMY OF SCIENCES FOR 1948

Academician V. P. Nikitin
Acting Secretary
Academy of Sciences

The following new institutes were established in 1948: Chemistry of Silicates, High Molecular Compounds, Precise Mechanics and Calculating Techniques, Marine Hydrophysics, and Petroleum. The Laboratory for the Solution of Problems of Wire Communication and the Mineralogical Museum were also organized. In the Ural Affiliate of the Academy, an Experimental Forestry Station was put into operation. The Daghestan Scientific Research Base of the Academy added the Institute of History, Language and Literature, the Physicochemical Laboratory, and the Experimental Station for Animal Husbandry. The Institute of Physiology was put into operation in the Academy of Medical Sciences.

The 1948 plan for the Academy of Sciences included 356 problems and 117 expeditions.

The plan for the Division of Physicomathematical Sciences included 35 problems. New and important results were obtained in the study of the structure of atomic nuclei (Physicotechnical Institute). It was established that the fine structure of gamma-spectra lines have a rotary character. A new physical phenomenon was discovered -- the emergence of positively charged particles of equal energy (monochromatic positrons). On the basis of this phenomena, a new method of determining the life period of disturbed nuclei was obtained.

In the Physics Institute imeni P. N. Lebedev, studies of nuclear fissions under the action of cosmic rays and formation processes of showers of charged particles were conducted at altitudes up to 28 kilometers. These studies established that nuclear fissions are caused by secondary, and not by primary, radiation. These studies also showed that despite the shower nature in the formation of secondary radiation, it still retains primary radiation in the original direction, which helps to explain processes occurring under the action of cosmic rays in the stratosphere.

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The Crimean astrophysical observatory obtained interesting new data on the chemism of certain stars. The so-called carbon stars have an incomparably higher content of the isotope C_{13} than on the Earth.

The classical methods of astronomical mechanics, which are used in establishing the theory of the motion of large planets, are practically inapplicable for the study of the motion of planetoids and especially comets, while the study of the motion of planetoids and comets has high significance for cosmogony.

In the Institute of Theoretical Astronomy, a theory of the motion of planetoids and comets was created on the basis of the newly developed method of periodic orbits. The motion of certain planetoids (Hestia, Triberga) was defined with great accuracy through the use of this theory. Good results were also obtained in describing the motion of the Dzhiakobini-Tsinner comet.

In the Mathematics Institute imeni V. A. Steklov, one of the most important problems in the theory of numbers was solved -- "the general law of reciprocity" was deduced.

Thirty-two problems were worked in the plan for the Division of Chemical Sciences.

The exact composition of gases must be known in order to obtain high-quality motor fuel of various types and valuable raw material for the chemical industry from domestic oils. In the Institute of Organic Chemistry, a new method which determines the individual components of gasolines quickly and accurately was devised. The method was relayed to the Ministry of Petroleum Industries for utilization. In the same Institute, work was completed on establishing the basis of the theory of linear polycondensation (molecule condensation), and the laws governing this process were described.

New results on the phenomena of adsorption were obtained in studies at the Institute of Physical Chemistry.

Thirty-six problems were included in the plan for the Division of Geological-Geographical Sciences. After long research, the Institute of Geological Sciences has composed a metallogenic map of Eastern USSR, scale 1 : 2,500,000.

On the basis of 3-year studies by the Azerbaydzhan Oil Expedition, the Council for the Study of Productive Forces has worked out the future indices (rayon by rayon) of the oil-bearing regions of the Azerbaydzhan SSR.

The Institute of Oceanography has developed a new, original physical-mathematical theory of equatorial counterflows. This theory is based on the diametrical irregularity of the wind as a factor exciting horizontal circulation. It was shown that the phenomena of counterflow is widely prevalent in nature. Theoretical postulates, coinciding with the results of direct observations in nature, permit the predetermination of counterflows which may be directed against a high-speed wind. This theory has real practical importance for navigation and the fishing industry.

The plan for the Division of Biological Sciences included 78 problems.

Studies on vegetative hybridization at the Institute of Genetics experimentally showed that the inheritance of characteristics acquired by the organism in the life process is not only possible but necessary. Inoculations of tomatoes produced changes in the hereditary features of the organism. The seeds of the plants which did not produce changes in the first generation yielded a breed that was changed in the second generation. The transformation of hard wheat into soft was also effected; this revealed the process of formation and transformation of one form of wheat into another. The solution of these problems proved convincingly the role of environment in the formation of an organism's hereditary characteristics.

Studies at the Forestry Institute established, in contrast to the existing opinion that forests dry up soils, that the level of soil waters and the soil moisture was higher in flatland forests, particularly in pine groves on sandy soils, than in fields situated nearby. The same Institute developed a method for the culture of various forms of the spindle tree at experimental plantations. The Institute also brought out the possibility of increasing the gutta from the cores of spindle tree stems by grounding the stems. This should increase the raw-material stores of gutta-percha considerably.

One of the first antibiotics to be used in medicine in the USSR was Soviet gramicidin, or gramicidin S. However, even in the pure crystallic state, this substance has considerable toxicity and also is insoluble in water, both of which facts lower its value and limit its use. In the Institute of Biochemistry imeni A. N. Bakh, scientists succeeded in changing the structure of gramicidin S to obtain a "water-soluble gramicidin." The new substance is soluble in water and is only half as toxic while possessing the same activity as gramicidin S. The new substance is more suitable for external use.

Investigations conducted by the same Institute aided by scientific institutions of the Ministry of Fishing Industries established that the stores of fish necessary for the production of vitamin A from livers of fish, whale, etc., would be enormous, about 40 trillion units. A better method of obtaining concentrates of vitamin A from whale liver, developed by the Institute, makes it possible to obtain the necessary fats for vitaminization of products (margarine, etc.) with a content of 75,000 - 125,000 units per gram. The size of the whale liver cuts allow the production of concentrates to be placed on a mass basis (5 - 7 trillion international units). The Institute confirmed the possibility of complete utilization of fish livers to obtain vitamins A and D simultaneously and also the possibility of obtaining vitamin D from molluska by the same method.

Experiments carried out in the Physiological Institute imeni I. P. Pavlov using methyl-thiouracil in fattening pigs proved that it is possible to discontinue the function of the thyroid gland. As a result of this, the increase in weight of the experimental pigs after 20 - 40 days was 50 - 100 percent greater than their original weight in the preparatory period and 25 - 30 percent greater than the increase in weight of the control group. The activity of methyl-thiouracil is 4 - 5 times greater than the activity of thiouracil (the substance used in the USA). The Ministry of the Meat and Milk Industries has begun to use the data obtained in the "Vyborgskiy" animal husbandry sovkhoz.

The plan for the Division of Technical Sciences contained 35 problems.

In the Institute of Metallurgy methods were developed which permit the determination of the speeds of certain reducing reactions of metallurgical processes. These reactions should provide a foundation for intensification and development of new technological plans for metal production. A power-metallurgical plan was developed to obtain cast iron from powdered iron ores using increased concentrations of oxygen in blowing.

Up to the present there has not existed a proven theory of creep in metals, a fact which has made it impossible to carry out accurate calculations for the basic parts of units operating at high temperatures, in particular for those units involved in new engineering developments. A theory has been worked out in the Institute of Machines and the Institute of Mechanics which explains experimental data from the field of the creep of metallic parts under variable loads. The new theory can be used to calculate the strength of basic boiler and turbine parts with sufficient accuracy for practice. A number of problems relating to pipes, rods, bars, and rotating discs were also solved. The results of the work will be used by organizations designing units to operate under high temperature conditions (gas turbines, steam-powered units, etc.).

An experimental-theoretical study of problems of dynamic synthesis was carried out in the Institute of Machines. Data obtained on a specially constructed unit should prove valuable in solving design and engineering problems concerning the pawl mechanisms for motors and automatic devices.

The Power-Engineering Institute has worked out a plan for the complete electrificat. n of agriculture, including the electrification of cultivation using electrical machine-tractor stations with the Soviet type of electric tractors constructed by ENIN-VIME. Factory and field testing of these electric tractors was successfully carried out in 1948. The proposed plan calls for efficient utilization of the electrical unit of the tractor in field work as well as for stationary processes throughout the entire year and thus eliminates the seasonal use of the tractor park. Three experimental machine-tractor divisions of MTS with ENIN-VIME electric tractors are under construction in 1949 by decree of the Council of Ministers of the USSR -- in the Ukrainian SSR, and in Ryazan and Sverdlovsk oblasts.

In the Institute of Automatics and Telemechanics, instruments were constructed for complete automatic control of oil well conditions (pressure, temperature, etc.). The instruments are being tested under industrial conditions.

In the period 1946-1948, the Section for the Scientific Solution of Problems of Electric Welding and Electrothermics designed a new type of welding transformer and regulator (reactive winding), which is different from the welding transformers now in use in the USSR in that it has a separate regulator-choke. This type of welding transformer is an up-to-date development of the basic principle in creating a combined transformer-regulator, which was first brought out and perfected in the Soviet welding transformer. In accordance with a decree of the Council of Ministers of the USSR, the STAN and STN transformers are being introduced into the economy. Preparations for series production of welding transformers in factories are being conducted with the direct participation of the Section. Series production of welding transformers in the USSR is already set up.

The Mongolian Agricultural Survey Expedition of the Academy of Sciences and the Committee of Sciences of the Mongolian People's Republic drew up a map (the first for the Republic) of water surfaces in 1947-1948,

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scale 1 : 1,000,000. A map of the pasture grounds of the Mongolian Peoples Republic was also drawn up, scale 1 : 1,000,000 and was subdivided into groups according to economic value. The fodder resources of the Mongolian People's Republic should facilitate the development of animal husbandry. The expedition worked out measures for organizing the water supply in the Republic, and together with the Committee of Sciences of the Mongolian People's Republic established a chemical laboratory for water analysis and an experimental station for animal husbandry.

The plan for the Council on the Study of Productive Forces contained eight problems. In 1948, the Council successfully finished several important survey investigations concerning the development of industries of the Urals, Caucasus, and Northwestern USSR. The results of these investigations are being used in the national economy. The working deputies of the Council, together with the State Planning Commission of the USSR and the Executive Committee of the Kemerovo Oblast Council, organized and conducted a conference on the study of the productive forces of the Kuznetsk Basin from 17 November to 23 November 1948. The conference summed up the information on the natural resources of the basin, analyzed the natural and economic conditions for its development, defined its part in the economy of the Union and particularly in the economy of the eastern regions of the USSR, and earmarked the directions and dimensions of further development of the leading branches of its industry, transport, business, agriculture, and culture.

From 1947 to 1948, the Academy of Sciences completed 165 different scientific works and transmitted them for introduction into the economy or for testing under production conditions. However, the work of the institutes of the Academy of Sciences in introducing the results of finished scientific investigations into the economy is still not satisfactory. This is due to lack of attention to this problem on the part of bureau leaders of divisions, institutes, laboratories, and the authors of the finished studies, as well as imperfect liaison of the leaders of divisions and institutes with ministries, factories, agriculture, and institute branches.

In the past year, the Academy of Sciences has carried out extensive and diverse work in coordinating the scientific activity of the Academies of Sciences of republics, affiliate scientific-research institutes, and chairs of higher institutions of learning.

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